TEXSCAN

VS-81

SWEEP GENERATOR VS-81

OPERATING AND INSTRUCTION MANUAL

Texscan

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OPERATING AND INSTRUCTION MANUAL

MODEL VS-81

SWEEP GENERATOR

CONTRACT NO: DOT FA70WA-2244
CONTRACT DATE: 24 SEPT. 1969

TEXSCAN CORP.
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Indianapolis, Indiana 46219
317-357-8781

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GUARANTEE

(a) The Contractor guarantees each item delivered under the contract against defects in design, material or workmanship, and against any damage caused prior to delivery to the Government. Unless otherwise specified, this guarantee extends for a period of one year from the date of first use by the Government or two years from date of delivery, whichever first occurs.

(b) Upon notice in writing, the Contractor shall promptly repair or replace all defective or damaged items delivered under the contract, f.o.b. any point or points designated by the Government within the 48 contiguous states and the District of Columbia, at no cost to the Government. The Contractor may elect to have any replaced item returned to his plant at his expense.

(c) Unless they fail as a result of improper application by the Contractor, electron tubes, batteries, natural rubber and material normally consumed in operation are excluded from this guarantee, but shall in any event be guaranteed by the Contractor to the extent of any guarantee received by the Contractor from his supplier.

(d) If twenty percent (20%) or more of the total quantity of any part or component to which this guarantee applies (but not fewer than two of any such part or component) fails in normal service, that fact shall be conclusive evidence that the design, material or workmanship of the item delivered under the contract is unsuitable for the purpose intended. Upon notice of this failure rate, the Contractor shall: (i) replace all quantities of the part or component with a corrected part or component in a manner satisfactory to the Government and at no cost to the Government; and (ii) if necessary to insure correction of the deficiency, redesign the item delivered under the contract, or any portion thereof, in a manner satisfactory to the Government and at no cost to the Government. The provisions of this paragraph (d), however, shall not apply to any part or component to be furnished which is specifically identified in the contract by brand name; provided, however, that the Contractor shall guarantee such part or component to the extent of any guarantee received by the Contractor from his supplier.

(e) For a period of one year from the date of its first use by the Government or two years from the date of its replacement or redesign, whichever first occurs, each item (or portion thereof) or part or component, which is replaced or redesigned pursuant to paragraph (d) above, shall itself be guaranteed in accordance with the terms of paragraph (d).

(f) The guarantee periods specified herein shall exclude any period of time an item fails to perform satisfactorily due to defects or damage to which this guarantee applies.

TABLE OF CONTENTS

SECTION		PAGE
1 - SPECIFICATIONS		1-1
2 - RF SECTION		
	2.1 High Band Oscillator	2-1
	2.2 CW Oscillator/Mixer	2-1
	2.3 Video Amplifier	2-1
	2.4 Trouble Shooting Chart	2-1
	RF Section Schematic	2-2
	Parts List	2-3
3 - GENERAL DESCRIPTION		
	3.1 General Information	3-1
	3.2 Introduction	3-1
	3.3 Power Supply	3-1
	115V, 230V Hookup	3-2
	Block Diagram	3-3
	3.4 Sweep Drive & Blanking Circuits	3-4
	3.5 Linearity Circuit	3-5
	3.6 Leveler	3-6
	Plug-In Marker Hookup	3-8
4 - OPERATING INSTRUCTIONS		
	4.1 Description of Front Panel Controls	4-1
	4.2 Description of Rear Panel Controls	4-2
	Front Panel Controls	4-3
	4.3 Typical Test Setup	4-4
	Typical Test Setup	4-5
5 - ADJUSTMENT PROCEDURE		
	5.1 Introduction	5-1
	5.2 Explanation of Internal Controls	5-1
	5.3 Power Supply	5-2
	Component Layouts	5-3
	Component Layouts	5-4
	5.4 Rate Generator	5-5
	5.5 Linearity Circuit	5-6
	5.6 RF Level Adjustment	5-6
	5.7 Marker Size	5-7
	5.8 Sweep Oscillator, Mixer, & Video Amplifier	5-7
	5.9 Spurious Content & Harmonic Distortion	5-7
6 - MAINTENANCE		
	6.1 Introduction	6-1
	6.2 Trouble Shooting Chart	6-1
	Rate, Linearity, Blanking, & Leveler Circuits	6-3
	Power Supply	6-4
	Marker Circuit	6-5
	Parts List	6-6

SECTION 1
SPECIFICATIONS

1.1	FREQUENCY RANGE	Low band: 1-400 MHz High band: 400-1350 MHz center frequency 390-1400 MHz swept
1.2	SWEEP WIDTH	

FREQUENCY	SWEEP WIDTH
200 MHz	50 kHz to 50 MHz
500 MHz	50 kHz to 100 MHz
1000 MHz	200 kHz to 350 MHz
1200 MHz	200 kHz to 400 MHz
150 MHz (Low Band)	200 KHz to 300 MHz

1.3	RF OUTPUT	±6 dbm into a 50 ohm load. .49 V rms
1.4	IMPEDANCE	50 ohm.
1.5	DISPLAY LINEARITY	5%. Output frequency versus time is better than 5% linear as referenced to a straight line function.
1.6	FLATNESS	±.5 db at full sweep width.
1.7	SPURIOUS & HARMONIC DISTORTION	At least 26 db from 20 MHz to 1350 MHz.
1.8	ATTENUATION	0-3 db vernier. 0-70 db in 10 db steps. 0-10 db in 1 db steps.
1.9	SWEEP RATE	1. Line rate 2. 5-60 Hz 3. .05-5 Hz 4. Manual 5. External
1.10	HORIZONTAL DRIVE	A triangular waveform of at least 7 volts peak to peak is provided for oscilloscope horizontal drive.
1.11	MONITOR	1. Internal 2. External
1.12	BLANKING	1. RF blanking 2. Video blanking 3. Internally selectable

1.13	MARKERS	A birdy-by-pass system with eight sockets for single or harmonic markers and connector for external CW source is provided. Single frequency markers are provided at 62.1 MHz, 62.65 MHz, 63.0 MHz, 63.35 MHz, and 63.9 MHz. 1 MHz, 10 MHz, and 50 MHz harmonic markers are also provided.
1.14	POWER CONSUMPTION	Approximately 15 watts; 50/60 Hz; 115/230 volts.
1.15	SIZE	6 7/8" X 17" X 16".
1.16	WEIGHT	Approximately 24 lbs.

SECTION 2

RF SECTION

2.1 HIGH BAND OSCILLATOR

The high band oscillator is a tuned line, varactor swept oscillator, using transistor, Q501 and is tunable over the frequency range of 400-1350 MHz. Sweeping range is from 390-1400 MHz.

2.2 CW OSCILLATOR/MIXER

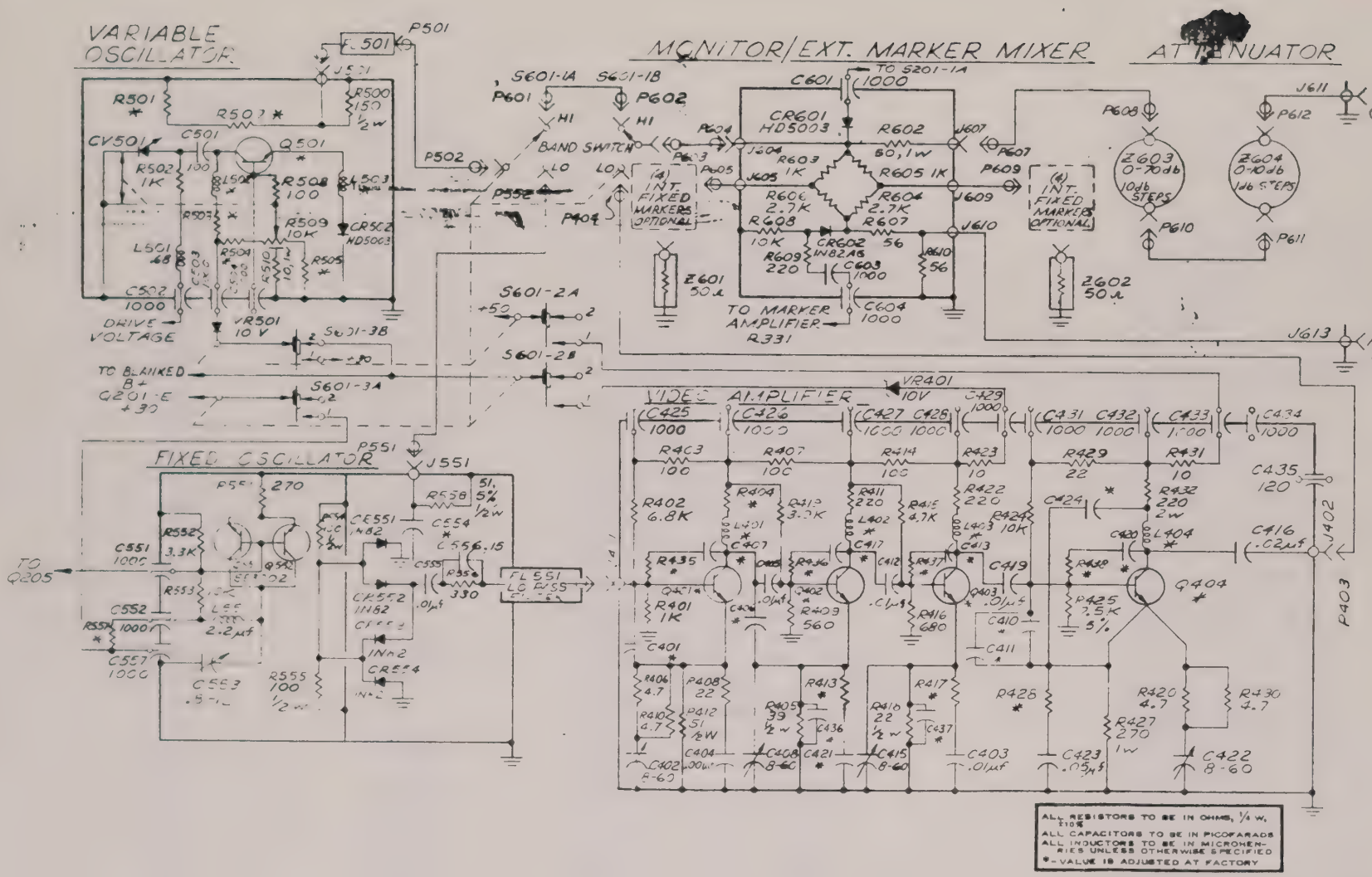
On the low band position, a CW oscillator operates at 800 MHz. The outputs of the CW and the tunable high band oscillator are mixed in the mixer bridge consisting of CR551, CR552, CR553, and CR554. The lower sideband is coupled to a 400 MHz video amplifier through the low pass filter, FL551.

2.3 VIDEO AMPLIFIER

The video amplifier schematic is also shown in figure 2-1. It consists of four gain stages with staggered feedback to accomplish the 400 MHz bandwidth. To keep the CW oscillator stable, blanking is applied to the first three stages of the video amplifier in the RF blanking mode.

2.4 TROUBLE SHOOTING CHART

SYMPTOM	CHECK
2.4.1	
No RF output; both bands.	Power supply voltage; leveler voltage; Q501,D501,CR601; coaxial switch and cables.
2.4.2	
RF output on high band; no output on low band.	Q551,Q552,Q404,Q405,Q406,Q407, CR551 thru CR554; +50V supply; coaxial switch and cables.


VARIABLE OSCILLATOR
MONITOR/EXT. MARKER MIXER
ATTENUATOR
FIXED OSCILLATOR
VIDEO AMPLIFIER
P501
J501
L501
P502
P552
P404
S601-1A
S601-1B
P601
P602
HI
LO
BAND SWITCH
S601-2A
S601-2B
S601-3A
S601-3B
TO BLANKED B+ Q201-E +30
DRIVE VOLTAGE
VR501 10 V
P551
J551
TO Q205
FL551 LO PASS
C601
TO 5201-1A
1000
CR601 HD5003
R602 80, 1W
R603 1K
R605 1K
R604 2.7K
R606 2.7K
R608 10K
R607 56
R609 220
CR602 1N82AG
C603 1000
R610 56
C604 1000
TO MARKER AMPLIFIER R331
(4) INT. FIXED MARKERS OPTIONAL
Z601 50Ω
Z602 50Ω
P603
P604
P605
P606
P607
P608
P609
P610
P611
P612
J607
J609
J610
Z603 0-70db 10db STEPS
Z604 0-10db 1db STEPS
J611
RF OUT (FP)
J613
EXT. MARKER (FP)
VR401 10V
C429 1000
C425 1000
C426 1000
C427 C428 1000 1000
C431 C432 1000 1000
C433 1000
C434 1000
R403 100
R407 100
R414 100
R423 10
R429 22
R431 10
C435 120
R402 6.8K
R404
R411 220
R422 220
R424 10K
R432 220 2W
C424
C416 .02μf
J402
P403
R435
R436
R437
R438
Q404
R401 1K
R403 560
R416 680
C410
C411
R425 2.5K 5%
C401
R406 4.7
R408 22
R412 51 1/2W
R405 39 1/2W
R413
R417
R418 22 1/2W
R428
R420 4.7
R430 4.7
R427 270 1W
C402 8-60
C404 .001μf
C408 8-60
C421
C415 8-60
C403 .01μf
C423 .05μf
C422 8-60
R501
R500 150 1/2W
R502 1K
R507
R508 100
R509 10K
R503
R504
R510 10
R505
C501 100
Q501
CR502 HD5003
C502 1000
C503
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ALL RESISTORS TO BE IN OHMS, 1/4 W, ±10%
ALL CAPACITORS TO BE IN PICOFARADS
ALL INDUCTORS TO BE IN MICROHENRIES UNLESS OTHERWISE SPECIFIED
*- VALUE IS ADJUSTED AT FACTORY

FIGURE 2-

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
C401		Factory Selected Value	
C402	015-009	Capacitor, Variable, 8-60pf	Texscan Corporation
C403	012-050	Capacitor, Fixed, .01uf	Arco 404
C404	012-009	Capacitor, Fixed, 1000pf	RMC TA.01
C405	012-050	Capacitor, Fixed, .01uf	RMC SM.001
C406	012-096	Capacitor, Fixed, 8pf	RMC TA.01
C407		Factory Selected Value	RMC TC NPO
C408	015-009	Capacitor, Variable, 8-60pf	Texscan Corporation
C410	012-083	Capacitor, Fixed, 12pf	Arco 404
C411	012-103	Capacitor, Fixed, 15pf	RMC 12 NPO
C412	012-050	Capacitor, Fixed, .01uf	RMC 15 NPO
C413		Factory Selected Value	RMC TA.01
C415	015-009	Capacitor, Variable, 8-60pf	Texscan Corporation
C416	012-114	Capacitor, Fixed, .02uf	Arco 404
C417		Factory Selected Value	RMC TA.02
C419	012-050	Capacitor, Fixed, .01uf	Texscan Corporation
C420		Factory Selected Value	RMC TA.01
C421		Factory Selected Value	Texscan Corporation
C422	015-009	Capacitor, Variable, 8-60pf	Texscan Corporation
C423	012-134	Capacitor, Fixed, .05uf,100V	Arco 404
C424		Factory Selected Value	Sprague TG-S-50
C425	012-001	Capacitor, Fixed, 1000pf	Texscan Corporation
C426	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
C427	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
C428	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
C429	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
C431	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
C432	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
C433	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
C501	012-118	Capacitor, Fixed, Chip, 100pf	JFD RCJ81B
C502	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
C503	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
C504	012-002	Capacitor, Fixed, 1000pf	Allen Bradley FW5C-102W
C551	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
C552	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
C553	015-004	Capacitor, Variable, 0.8-12pf	JFD VC-22GY
C554		Factory Selected Value	Texscan Corporation
C555	012-005	Capacitor, Fixed, .01uf	RMC Z5U.01
C556	012-103	Capacitor, Fixed, 15pf	RMC 15 NPO
C557	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
C601	012-002	Capacitor, Fixed, 1000pf	Allen Bradley FW5V-102W
C603	012-009	Capacitor, Fixed, 1000pf	RMC SM.001
C604	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
CR502	025-016	Diode, HD5003	Hughes HD5003
CR551	025-027	Diode, 1N82	Sylvania 1N82
CR552	025-027	Diode, 1N82	Sylvania 1N82
CR553	025-027	Diode, 1N82	Sylvania 1N82
CR554	025-027	Diode, 1N82	Sylvania 1N82
CR601	025-016	Diode, HD5003	Hughes HD5003
CR602	025-002	Diode, 1N82AG	Sylvania 1N82AG
CV501	064-006	Varactor	Varian VAT-22-ET
FL501	A204-348	1200 MHz, Filter	Texscan Corporation
FL551	A204-473	400 MHz, Filter	Texscan Corporation
J401	020-030	Connector, RF, UG185/U	Startronic UG185/U
J402	020-011	Connector, RF, UG625B/U	Startronic UG625B/U
J501	020-044	Connector, RF, UG535/U	Startronic UG535/U
J551	020-030	Connector, RF, UG185/U	Startronic UG185/U

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
J604	020-011	Connector, RF, UG625B/U	Startronic UG625B/U
J605	020-018	Connector, RF, MX1684/U	Startronic MX1684/U
J607	020-011	Connector, RF, UG625B/U	Startronic UG625B/U
J609	020-018	Connector, RF, MX1684/U	Startronic MX1684/U
J610	020-018	Connector, RF, MX1684/U	Startronic MX1684/U
J611	020-017	Connector, RF, 5070	Startronic 5070
J613	020-017	Connector, RF, 5070	Startronic 5070
L401		Factory Selected Value	Texscan Corporation
L402		Factory Selected Value	Texscan Corporation
L403		Factory Selected Value	Texscan Corporation
L404		Factory Selected Value	Texscan Corporation
L501	035-004	Inductor, 0.68uh	Jeffers 4426-4K
L502		Factory Selected Value	Texscan Corporation
L503		Factory Selected Value	Texscan Corporation
L551	035-002	Inductor, 2.2uh	Jeffers 4436-4K
P403	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P404	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P501	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P502	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P551	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P552	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P601	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P602	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P603	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P604	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P605	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P607	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P608	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P609	020-021	Connector, RF, UG88C/U	Startronic UG88C/U

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
P610	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P611	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
P612	020-021	Connector, RF, UG88C/U	Startronic UG88C/U
Q401	062-035	Transistor, 2N5109	RCA 2N5109
Q402	062-035	Transistor, 2N5109	RCA 2N5109
Q403	062-035	Transistor, 2N5109	RCA 2N5109
Q404	062-031	Transistor, 2N4429	TRW 2N4429
Q501	062-051	Transistor, FT-37	Fairchild FT-37
Q551	062-013	Transistor, SE3002	Fairchild SE3002
Q552	062-013	Transistor, SE3002	Fairchild SE3002
R401	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R402	045-745	Resistor, Fixed, 6.8K ohm, ½W, 10%	Allen Bradley
R403	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R404		Factory Selected Value	Texscan Corporation
R405	046-051	Resistor, Fixed, 39 ohm, ½W, 10%	Allen Bradley
R406	045-612	Resistor, Fixed, 4.7 ohm, ½W, 10%	Allen Bradley
R407	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R408	045-640	Resistor, Fixed, 22 ohm, ½W, 10%	Allen Bradley
R409	045-700	Resistor, Fixed, 560 ohm, ½W, 10%	Allen Bradley
R410	045-612	Resistor, Fixed, 4.7 ohm, ½W, 10%	Allen Bradley
R411	045-682	Resistor, Fixed, 220 ohm, ½W, 10%	Allen Bradley
R412	046-056	Resistor, Fixed, 51 ohm, ½W, 5%	Allen Bradley
R413		Factory Selected Value	Texscan Corporation
R414	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R415	045-738	Resistor, Fixed, 4.7K ohm, ½W, 10%	Allen Bradley
R416	045-703	Resistor, Fixed, 680 ohm, ½W, 10%	Allen Bradley
R417		Factory Selected Value	Texscan Corporation
R418	046-040	Resistor, Fixed, 22 ohm, ½W, 10%	Allen Bradley

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R419	045-735	Resistor, Fixed, 3.9K ohm, ¼W, 10%	Allen Bradley
R420	045-612	Resistor, Fixed, 4.7 ohm, ¼W, 10%	Allen Bradley
R422	045-682	Resistor, Fixed, 220 ohm, ¼W, 10%	Allen Bradley
R423	045-626	Resistor, Fixed, 10 ohm, ¼W, 10%	Allen Bradley
R424	045-752	Resistor, Fixed, 10K ohm, ¼W, 10%	Allen Bradley
R425	045-747	Resistor, Fixed, 7.5K ohm, ¼W, 5%	Allen Bradley
R427	046-386	Resistor, Fixed, 270 ohm, 1W, 10%	Allen Bradley
R428		Factory Selected Value	Texscan Corporation
R429	045-640	Resistor, Fixed, 22 ohm, ¼W, 10%	Allen Bradley
R430	045-612	Resistor, Fixed, 4.7 ohm, ¼W, 10%	Allen Bradley
R431	045-626	Resistor, Fixed, 10 ohm, ¼W, 10%	Allen Bradley
R432	046-682	Resistor, Fixed, 220 ohm, 2W, 10%	Allen Bradley
R435		Factory Selected Value	Texscan Corporation
R436		Factory Selected Value	Texscan Corporation
R437		Factory Selected Value	Texscan Corporation
R438		Factory Selected Value	Texscan Corporation
R500	046-075	Resistor, Fixed, 150 ohm, ½W, 10%	Allen Bradley
R501		Factory Selected Value	Texscan Corporation
R502	045-710	Resistor, Fixed, 1K ohm, ¼W, 10%	Allen Bradley
R503		Factory Selected Value	Texscan Corporation
R504		Factory Selected Value	Texscan Corporation
R505		Factory Selected Value	Texscan Corporation
R507		Factory Selected Value	Texscan Corporation
R508	045-667	Resistor, Fixed, 100 ohm, ¼W, 5%	Allen Bradley
R509	048-095	Resistor, Variable, 10K ohm	Allen Bradley JA4G132F103
R510	046-326	Resistor, Fixed, 10 ohm, 1W, 10%	Allen Bradley
R551	045-686	Resistor, Fixed, 270 ohm, ¼W, 10%	Allen Bradley
R552	045-731	Resistor, Fixed, 3.3K ohm, ¼W, 10%	Allen Bradley
R553	045-752	Resistor, Fixed, 10K ohm, ¼W, 10%	Allen Bradley
R554	046-068	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R555	046-068	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R556	045-689	Resistor, Fixed, 330 ohm, ½W, 10%	Allen Bradley
R557		Factory Selected Value	Texscan Corporation
R558	046-056	Resistor, Fixed, 51 ohm, ½W, 5%	Allen Bradley
R602	046-286	Resistor, Fixed, 50 ohm, 1W, 1%	Allen Bradley
R603	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R604	045-728	Resistor, Fixed, 2.7K ohm, ½W, 10%	Allen Bradley
R605	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R606	045-728	Resistor, Fixed, 2.7K ohm, ½W, 10%	Allen Bradley
R607	045-658	Resistor, Fixed, 56 ohm, ½W, 10%	Allen Bradley
R608	045-752	Resistor, Fixed, 10K ohm, ½W, 10%	Allen Bradley
R609	045-682	Resistor, Fixed, 220 ohm, ½W, 10%	Allen Bradley
R610	045-658	Resistor, Fixed, 56 ohm, ½W, 10%	Allen Bradley
S601	A200-030-02	Switch	Texscan Corporation
VR501	025-010	Diode, Zener, VR10A	Sarkes Tarzian VR10A
Z601	A200-005-01	Termination, Coaxial	Texscan Corporation
Z602	A200-005-01	Termination, Coaxial	Texscan Corporation
Z603	B200-200-15	Attenuator, 70 db	Texscan Corporation
Z604	B200-200-00	Attenuator, 10 db	Texscan Corporation

SECTION 3

GENERAL DESCRIPTION

3.1 GENERAL INFORMATION

This sweep generator is a solid state instrument that provides wide frequency coverage, variable sweep rate, external marker capability, and complete control of the RF output level. Eight sockets are provided to accept single frequency or harmonic plug-in markers for accurate frequency identification.

Additional features are manual sweep, external leveling, and external drive.

The transistors used are all silicon, and the low frequency circuits are assembled on high quality printed circuit boards for maximum reliability and serviceability.

3.2 INTRODUCTION

The block diagram, shown in figure 3-2 can be divided into five major sections:

1. Power supply
2. Sweep drive and blanking circuits
3. Leveling circuit
4. Marker circuit
5. Oscillator/video amplifier

The following paragraphs present a description of the circuit details of the first four sections. The oscillator is described in Section 2.

3.3 POWER SUPPLY

The DC power supply for this unit is shown in figure 6-3. This circuit provides regulated +30V, +200V, and -30V, and an unregulated +50V. The input winding of transformer, T1 is designed so that the unit can be wired for either 115V or 230V line voltage. The units are normally shipped wired for 115V. To change from 115V to 230V operation, examine figure 3-1.

All the power supply voltages are derived from three full wave rectifiers. One full wave rectifier consisting of CR1 and CR4 is filtered with C1A, R17 and C1B; coupled through the pass transistor, Q9. This is the +200V regulated supply. The voltage across the pass transistor is controlled by an amplified signal derived from the difference between the constant voltage source, I2, and the voltage on the upperarm of R21. Q11 is the voltage comparator-amplifier.

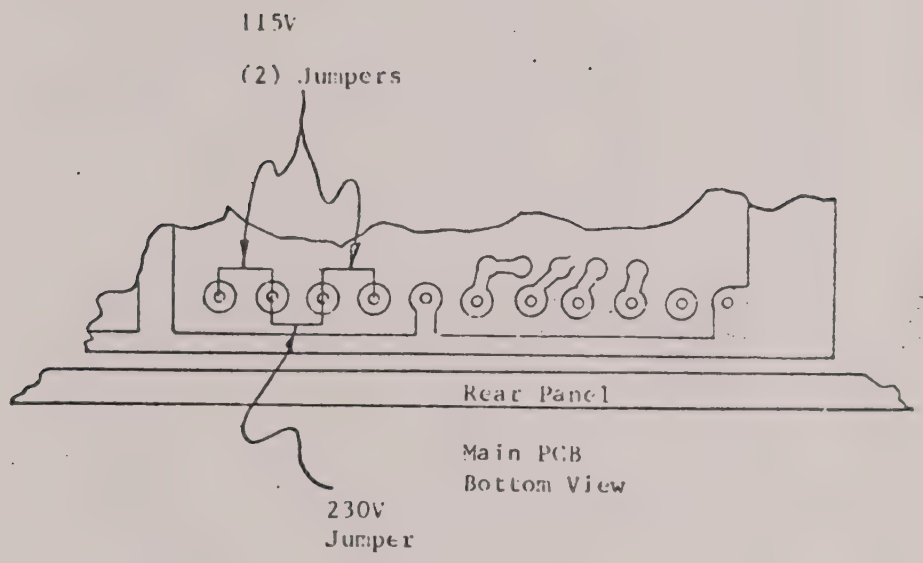
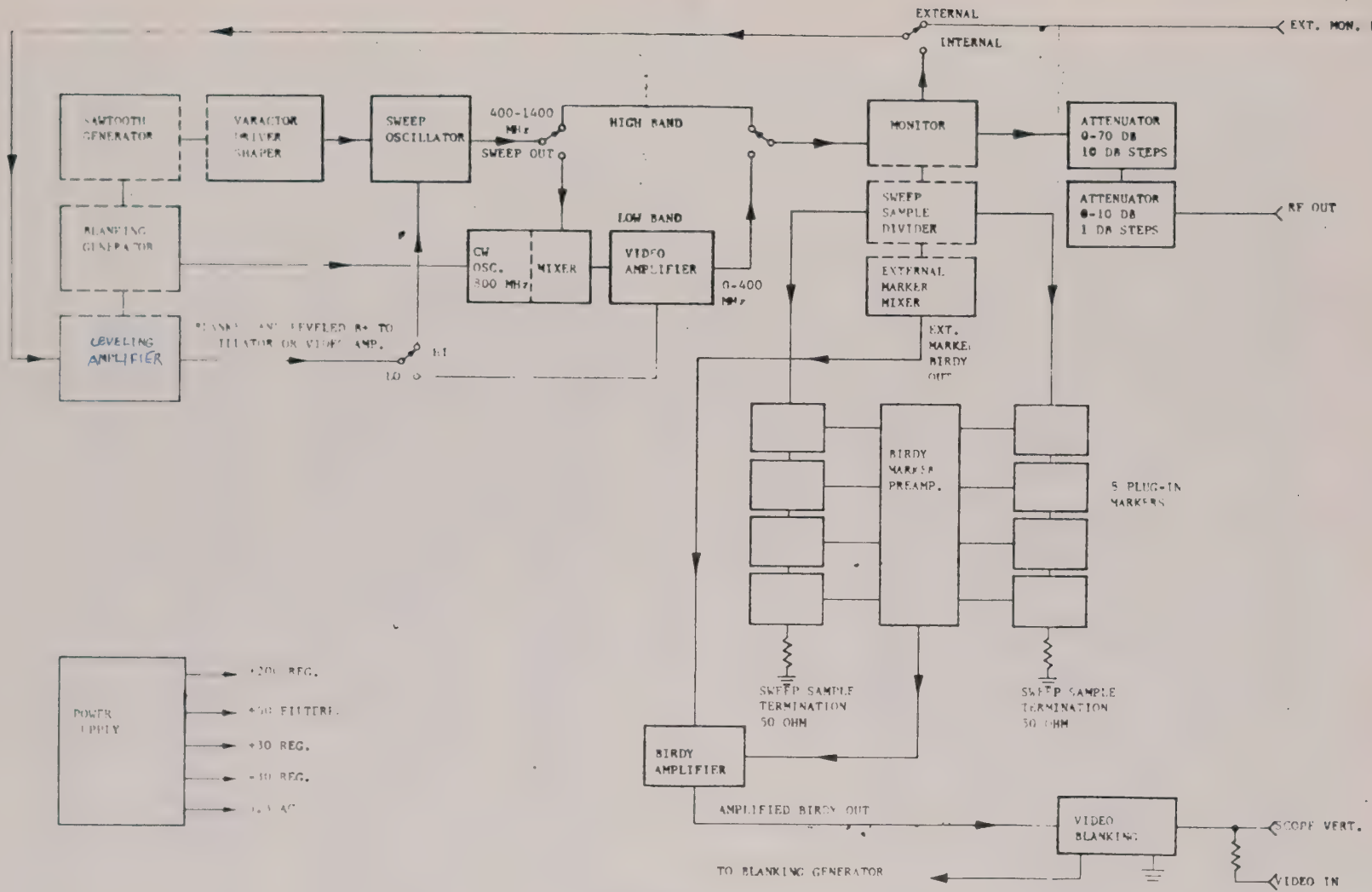


FIGURE 3-1
115V, 230V HOOKUP



BLOCK DIAGRAM

FIGURE 3-2

Any output voltage change that occurs as a result of line voltage change or load impedance change, is reflected back to the base of pass transistor, Q9 in the proper phase to compensate for this output voltage change. This well regulated DC voltage typically has an output ripple of 1 mv and maintains its regulation through a ±10% line voltage change.

The +30V supply is derived from CR2, CR6, filtered by D1D and fed to pass transistor, Q1. This works on the same principle as the +200V supply, except for this difference that a current limiter is added to the circuit. As soon as the current drain exceeds 460 ma, the voltage drop across R3 is 8.28 volts. Since 0.6V each is needed between base-emitter of Q1 and Q3, and 7V for CR8 to fire, then with 8.28V across R3, CR8 will fire and clamp the base of Q3. Consequently, the base of Q1 is clamped at approximately 37.6V. Ripple voltage at the output of the supply is less than 3 mv.

The +50V is taken from the input of the +30V regulated supply and filtered with R1, C1C, and C2. In units with video amplifiers, this voltage is used to power the output transistor of the video amplifier.

3.4 SWEEP DRIVE & BLANKING CIRCUITS

The rate generator provides the signal for:

1. Horizontal drive
2. Varactor sweep drive
3. Blanking signal for the oscillator power supply

3.4.1 Rate Generator

This circuit has five modes of operation, corresponding to the five sweep rate modes provided for the unit. The five modes are activated by changing the operating characteristics of the basic rate generator consisting of a Schmidt Trigger and Miller Integrator.

Transistors, Q101 and Q102 are incorporated in the Schmidt Trigger while Q103 and Q104 are used in the Miller Integrator. The combination of a Schmidt Trigger and Miller Integrator provides square wave and triangular wave outputs with a fixed phase relationship. The square wave is present at the collectors of Q101 and Q102, and the triangular wave at the collector of Q104. The circuit provides these signals with constant amplitude over the frequency range of the rate generator.

The sweep rate, which is determined by the time constant of C102 and R120B is changed by varying R120B, the front panel sweep rate vernier control. For the slower rate position, capacitor, C103 is added to the circuit and R120B is replaced by a larger value resistor, R120C, which is ganged with R120B.

The sweep rate switch, S103 selects between five modes of operation. The two variable modes have been discussed before.

In the line rate position, a 60 Hz signal from the power transformer is coupled through C101 and C106 to the base of Q101. This signal locks the

generator to the line frequency. The other poles of S103 convert the circuit time constants to insure locking phase and same amplitude signal as in the free-running mode.

In the manual position, S103 by-passes the rate circuit and provides a DC voltage at the generator output. R120A adjusts this output voltage through the same amplitude swing as from the rate generator.

The last switch position; the external sweep rate position, also by-passes the rate circuit and allows the unit to be swept with an external source.

3.4.2 Blanking

The square waves at the collectors of Q101 and Q102 provide the properly phased signals for RF and video blanking.

A slide switch, S102, on the main printed circuit board selects between these two modes of blanking.

In the RF blanking position, the square wave controls the transistors that supply the voltages to the RF oscillator or video amplifier and CW oscillator. During retrace time, these supply voltages are turned off.

In the video blanking position, the properly phased signal activates an electronic switch, Q109, which shorts the scope vertical connector to ground potential during retrace time.

3.5 LINEARITY CIRCUIT

The emitter follower, Q105, is the coupling stage between the rate circuit and the linearity circuit. It provides the drive voltage for the linear amplifier, Q106, and the non-linear amplifier, Q107.

The diode break circuit, consisting of R137 through R146, CR104 through CR113, and R148 through R158 distorts the drive signal at the collector of Q107. This circuit is piece-wise linear. For example, for any assumed combination or forward and back biased diodes, the circuit has a linear characteristic. As the voltage at the collector increases, sequentially, each of the diodes conduct and the resultant waveform is distorted. This distorted drive voltage is coupled to the sweep width switch and potentiometer combination, S101 and R164.

The amplified linear drive signal at the collector of Q106 is also coupled to this potentiometer and switch combination through the emitter follower, Q108. This linear drive voltage and the distorted drive voltage are added at this point in the proper proportions to maintain linearity as sweep width is reduced.

The output of S101 is the varactor drive voltage which is delivered to the sweep oscillator.

3.6 LEVELER

The leveler, also shown in figure 6-1, consists of a high gain DC amplifier and switch combination which provides a blanked and leveled B+ to the sweep oscillator on the high band and the video amplifier on the low band. The square wave from the rate circuit is coupled through the DC level setting stage, Q204 to the transistor switch, Q203. At the collector of Q203 is a switched DC voltage of sufficient amplitude to turn Q201 off and on at the sweep rate. The switched signal at the emitter of Q201 is properly phased with the sweep drive so that it turns off the sweep oscillator on the high band and the video amplifier on the low band during retrace time of the sweep oscillator. That is, the distorted triangular wave from the linearity circuit sweeps the oscillator in one direction with its positive slope, and in the opposite direction with its negative slope. The blanked B+ is properly phased to turn off the output signal during the negative slope portion of the sweep drive.

This same circuit amplifies the monitor signal and provides the B+ in the proper phase to compensate for RF output changes. The monitor signal is amplified with Q206, Q207, and Q202. This leveled signal is added to the blanking signal at the base of Q202. Q202 is an emitter follower whose output varies in opposite phase to the monitor signal change and is turned off during the sweep oscillator's retrace time.

The Q207 stage contains potentiometers for setting the maximum and minimum RF vernier levels. Diodes are used to protect the base emitter junctions of Q203 and Q201. Included in this circuit is a switch, S201, which by-passes the internal monitor and connects the leveler circuit to a front panel external monitor input connector. This allows the unit to be leveled from some remote location if the user provides a detected monitor signal from that leveling point.

3.7 MARKER AMPLIFIER/MIXER

The unit is supplied with a birdy-by-pass marker system; see figure 6-2. Also eight sockets that will accept single frequency or harmonic markers along with a mixer to accommodate an external signal source to provide a marker.

In the marker system, a sample of the swept RF output is mixed with the fundamental or harmonic of either plug-in or external signal source to produce beatnotes or birdies. The beatnotes are then amplified, shaped, and superimposed upon the demodulated video signal at the scope vertical output connector, J309 of the instrument.

The sweep sample out of the oscillator is divided into two branches for a more even distribution when multiple plug-in markers are used. The marker produced in each plug-in can be independently controlled in amplitude with potentiometers R305, R306, R311, R312, R317, R318, R324, and R325. This allows each marker to be adjusted to a different amplitude for easy identification of the various markers on the oscilloscope display.

The connection of the sweep sample cables to the plug-in marker sockets is accomplished as shown in figure 3-3.

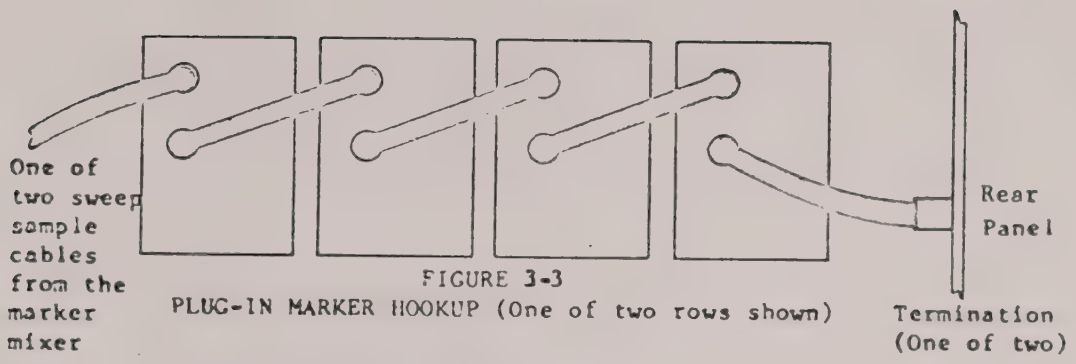


FIGURE 3-3
PLUG-IN MARKER HOOKUP (One of two rows shown)

SECTION 4

OPERATING INSTRUCTIONS

4.1 DESCRIPTION OF FRONT PANEL CONTROLS

A drawing of the front panel of the unit is shown in figure 4-2. An identification of each control and its function is as follows:

4.1.1 Center Frequency Dial

Indicates the frequency of the oscillator in the CW modes and at minimum sweep width in the sweep modes.

4.1.2 Power Switch

Switches on the line voltage to the unit.

4.1.3 RF Level Set Potentiometers

Two potentiometers are provided to set the maximum and minimum output power levels which can be obtained by varying the RF vernier control. These potentiometers are set at the factory for proper operation with the internal monitor system. They are provided as front panel controls so that if an external monitor is employed, these levels can be reset.

4.1.4 External Marker Size Control

Provides adjustment of the amplitude of the external marker, if used.

NOTE: Fixed marker size must be advanced for this control to operate.

4.1.5 Fixed Marker Size & Shaper

This dual control varies the size of the birdy markers provided from plug-in SM or HM markers. The shaper can be used to vary the bandpass of the birdy amplifier and, subsequently, narrow or widen the birdy marker width.

4.1.6 Band Selection Switch

This switch selects the low or high frequency band of the unit. The low band covers 1 MHz to 400 MHz, while the high band covers 390 MHz to 1400 MHz.

4.1.7 RF Vernier & Monitor Switch

The RF vernier provides continuously variable adjustment of the RF output level over a 3 db range..

4.1.8 Attenuation

The turret attenuator can be used to control the amplitude of the RF output by 70 db in 1 db increments.

4.1.9 Sweep Width Control

This potentiometer and switch combination is used to vary the sweep width of the output and to select the CW mode of operation.

4.1.10 Sweep Rate Control

This potentiometer and switch combination provides control of the rate at which the RF output is swept. Five modes are provided: (1) Line-50/60 Hz sweep rate, (2) Variable-5 to 60 Hz continuously variable, (3) Variable-.05 to 5 Hz continuously variable, (4) Manual-center knob can be used to manually sweep the frequency, and (5) External-external source may be employed to sweep the RF oscillator.

NOTE: Using a 400 Hz power source, the unit should not be operated in position 1.

4.1.11 Marker Switches

These switches are used to turn on or off any plug-in marker employed.

4.1.12 RF Out Connector

Connector for swept or CW output.

4.1.13 External Marker Connector

This connector allows an external signal source to be inserted to provide a marker on the video output.

4.1.14 Video In Connector

The detected RF from the device under test is inserted here to superimpose birdy markers on the detected signal.

4.1.15 Scope Vertical

The detected RF signal with markers superimposed is available at this connector for connection to the oscilloscope vertical channel.

4.1.16 Scope Horizontal

The oscilloscope horizontal drive signal is available at this connector.

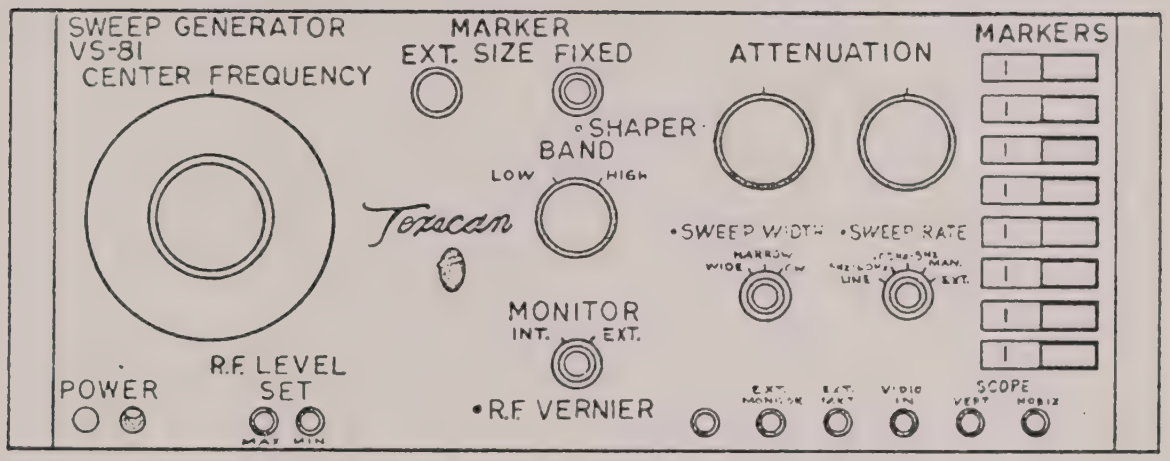
4.1.17 External Monitor Connection

The monitor signal from an external monitor, if used, is inserted here.

4.2 DESCRIPTION OF REAR PANEL CONTROLS

4.2.1 External Sweep Drive Connection

An external sweep drive signal can be inserted here to sweep the unit at a rate not provided internally.

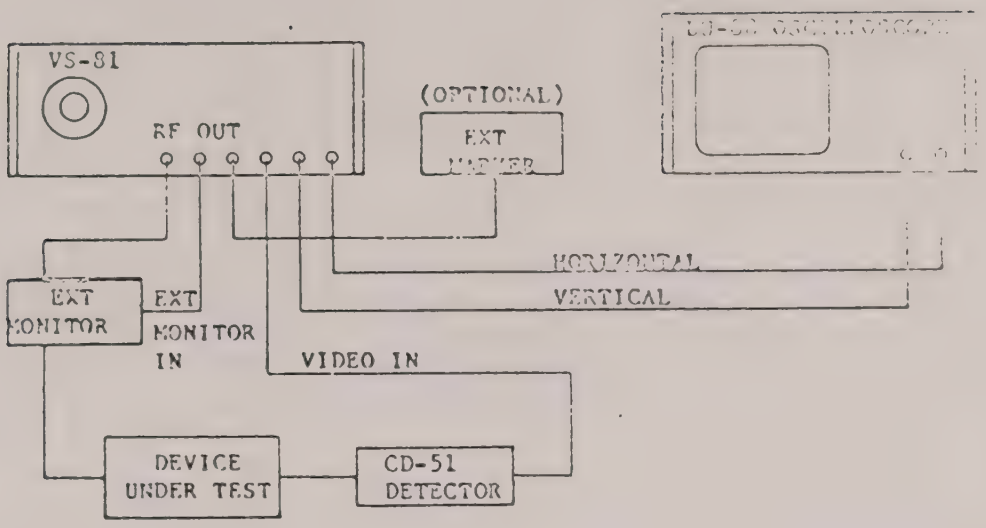


FRONT PANEL LAYOUT

FIGURE 4-2

4.3 TYPICAL TEST SETUP

Make connection to the oscilloscope, device under test, detector, and sweep generator as shown in figure 4-3.



TYPICAL TEST SETUP

FIGURE 4-3

SECTION 5

ADJUSTMENT PROCEDURE

5.1 INTRODUCTION

The adjustments and tests of this instrument can be accomplished with the following auxiliary test equipment -- an oscilloscope (such as HP-130), a VTVM, and a multimeter. It is suggested that the reader familiarize himself with the unit's circuit operation by reading Section 2 before attempting alignment of the instrument. Test of the unit for spurious level and harmonic distortion require a high frequency oscilloscope and a spectrum analyzer.

Section 5.2 gives a discussion of the internal controls which require identification during alignment of the unit. Subsequent sections describe in detail the alignment procedure for each circuit. All internal controls are properly adjusted at the factory and only minor adjustments should be required in the field due to aging or changing of components.

5.2 EXPLANATION OF INTERNAL CONTROLS

Refer to figure 5-1 to identify the location of each of the following controls.

5.2.1 R7, +30V Adjust

Adjusts the output voltage of the +30V power supply.

5.2.2 R14, -30V Adjust

Adjusts the output voltage of the -30V power supply.

5.2.3 R21, +200V Adjust

Adjusts the output voltage of the +200V power supply.

5.2.4 R101, Upper Trigger Point Adjust

Adjusts the upper trigger point for the Schmidt Trigger in the rate generator.

5.2.5 R106, Line DC Level Adjust

Adjusts the DC level of the rate generator output voltage in the line rate mode of operation so that it is equal to the DC level in the variable rate mode.

5.2.6 R108, Lower Trigger Point Adjust

Adjusts the lower trigger point for the Schmidt Trigger in the rate generator.

5.2.7 R119, Line Trigger Amplitude Adjust

Adjusts the amplitude of the rate generator output voltage in the line rate mode of operation so that it is equal to the amplitude in the variable rate mode.

5.2.8 R161, Wide Sweep Width Center Frequency Adjust

Adjusts the DC level of the linearity drive voltage and is used to adjust center frequency at wide sweep width.

5.2.9 R131, Medium Sweep Width Center Frequency Adjust

Adjusts the DC level of the linearity drive voltage and is used to adjust center frequency at medium sweep width.

5.2.10 R163, Sweep Width Limit Adjust

Adjusts the varactor drive size on the low band only, thereby adjusting the maximum sweep width.

5.2.11 R159, Wide Sweep Width Limit Adjust

Adjusts the linearity drive voltage and is used to set the maximum sweep width limit.

5.2.12 R167, Low Sweep Width Center Frequency Adjust

Adjusts the center frequency at narrow sweep widths.

5.2.13 R305,R306,R311,R312,R317,R318,R324,R325-Marker Size Adjusts

These controls provide individual adjustment of the marker size available from plug-in marker receptacles one through eight.

5.2.14 C553, CW Oscillator Frequency Adjust

Adjusts the oscillator frequency of the CW oscillator.

5.3 POWER SUPPLY

5.3.1

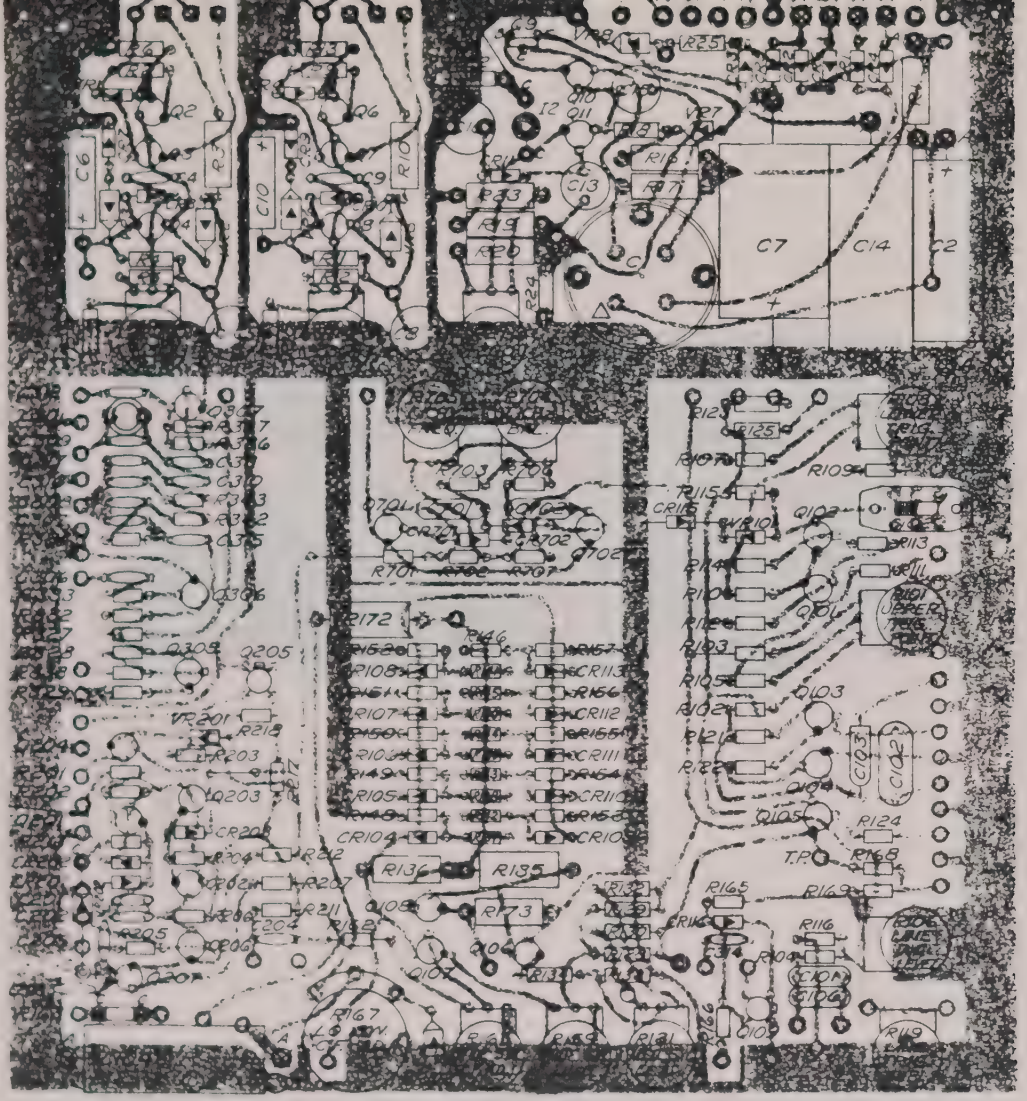
With the unit plugged in and the power switch on, monitor the -30V point with an accurate voltmeter and a high gain AC coupled oscilloscope at the -30V test point.

5.3.2

Adjust R14, the -30V adjust potentiometer for a -30V level. The AC ripple, as viewed on the scope should be less than 3 mv.

5.3.3

Connect the meter and scope to the +30V test point and adjust R7 for a +30V level. The ripple should be less than 3 mv.


C6
C10
C13
C7
C14
C2
R10
R24
R125
R109
R113
R124
R168
R169
R116
R135
R136
R173
R167
R146
R172
R218
R203
R205
R211
R212
R207
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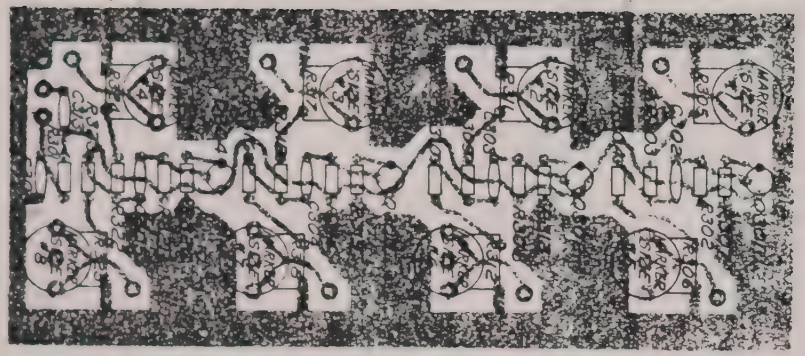


HOLE	DESCRIPTION	QTY

DRILL, PUNCH, AND
STOCK SIZES DO NOT

TEXSCAN CORPORATION

5.3.4

Connect the meter and scope to the +200V test point and adjust R21 for a +200V level. The ripple should be less than 2 mv.

5.4 RATE GENERATOR

5.4.1

To align the rate generator, perform the following operations:

5.4.1.1

Connect a direct coupled oscilloscope to the emitter of Q105.

5.4.1.2

Set the sweep rate function switch to variable.

5.4.1.3

Turn the power switch on.

5.4.2

Set the oscilloscope to internal sweep; 20 msec per 10 divisions. Note the limits of the voltage at emitter Q105. This voltage should vary from +1V to +22V, ±0.25 volt. If it doesn't, adjust R108 (lower trigger point adjust) and R101 (upper trigger point adjust) for this voltage swing. If it doesn't adjust, refer to Section 6 for trouble shooting instructions.

5.4.3

Rotate R120 throughout its range, and using the time base on the oscilloscope, verify that the frequency of the triangular wave is adjustable from below 5 Hz to above 60 Hz. As R120 is varied, the amplitude of the waveform should remain nearly constant.

5.4.4

Switch the sweep rate function switch to line position and adjust R106 and R119 until the triangular wave amplitude and DC level are the same as noted in 5.4.2.

5.4.5

Set the sweep rate function switch to manual. Verify that as R120 is varied the amplitude of the DC voltage at the emitter of Q105 varies between +1V and +22 volts.

5.4.6

Disconnect the scope probe from Q105 and connect it to the emitter of Q204. The presence of a 0 to 20 volt square wave indicates that the blanking circuit is operating.

5.4.7

If any of the steps cannot be completed, refer to Section 6 for trouble shooting procedures.

5.5 LINEARITY CIRCUIT

5.5.1

The unit is provided with no internal controls to adjust linearity, but the sweep width of this unit can be adjusted by performing the following operations:

5.5.1.1

Connect the unit to the oscilloscope as indicated in the typical test setup, figure 4-3, but omit the device under test.

5.5.1.2

The best method to use when adjusting sweep width requires a 50 MHz harmonic marker (HM-50). If another harmonic marker is available, it can be employed with note taken of the changes required in the following procedure.

5.5.1.3

If a 50 MHz harmonic marker is used, switch to the high band and set the center frequency adjustment knob to 1000 MHz. Adjust the oscilloscope horizontal gain for 10 cm of horizontal deflection.

5.5.1.4

Advance the sweep width potentiometer front panel control to full sweep width. Adjust R159 and R161 for centering of the 1000 MHz marker and 400 MHz sweep width. You will note that there will be approximately 15 MHz more sweep width above 1000 MHz than below. This is normal.

5.5.1.5

Slowly decrease sweep width and adjust R131 to maintain centering of the 1000 MHz marker. With it properly set at 50 MHz sweep width, go to the next step.

5.5.1.6

Rotate sweep width to near its minimum value and recenter the 1000 MHz marker with R167.

5.5.1.7

Repeat steps 5.5.1.3 through 5.5.1.6 to more finely adjust the settings.

5.6 RF LEVEL ADJUSTMENT

5.6.1

With the same setup as used in Section 5.5, set the RF vernier for maximum output.

5.6.2

Being certain that the monitor switch is set for internal monitoring, adjust the maximum level potentiometer for 0.5V detected output level as noted from the oscilloscope calibrated display.

5.6.3

Switch in 3 db of attenuation and note the vertical deflection on the oscilloscope.

5.6.4

Rotate the RF vernier for minimum output, remove the 3 db of attenuation, and adjust the minimum level potentiometer for the same level of detected output as noted in 5.6.3.

5.7 MARKER SIZE

5.7.1

Individual marker size controls are provided, as well as the front panel control, so that if a complicated set of markers are employed, their relative sizes can be set for easy identification.

5.7.2

For example, if 50 MHz, 10 MHz, and 1 MHz harmonic markers are all used with the front panel fixed marker size control about 3/4 clockwise, adjust the internal control for the HM-50 for 0.2 volt birdies, the HM-10 for 0.1 volt, and the HM-1 for 0.05 volt producing an easily identified display.

5.7.3

The fixed marker size control must be set for large marker size before adjusting the external marker size control. When testing the external marker function, be sure to have the fixed marker size control set for maximum size.

5.8 SWEEP OSCILLATOR, MIXER, & VIDEO AMPLIFIER

These circuits are such that adjustment of internal controls to realign is impractical. They are designed to require no adjustment in the field. These circuits should only be investigated when trouble shooting procedures have isolated a problem to that area.

5.9 SPURIOUS CONTENT & HARMONIC DISTORTION

5.9.1

The simplest way to determine the distortion and harmonic content level is with a spectrum analyzer.

5.9.2

Set the VS-80 for CW operation near 20 MHz.

5.9.3

Connect the RF output to the spectrum analyzer.

5.9.4

Tune from 20 MHz to 1350 MHz. Note and measure the magnitude of all spurious frequency components and harmonically related components. All should be 26 db below the wanted output.

SECTION 6

MAINTENANCE

6.1 INTRODUCTION

As in trouble shooting any electronic equipment, the best approach is to systematically attempt to isolate the problem to a particular circuit, and then a component, by the process of elimination. Before attempting to find any failure, it is suggested that the trouble shooting technician or engineer become familiar with the equipment by reading Sections 3 and 4 of this manual. The following section, Section 6.2 present a trouble shooting chart which lists some of the more common failures. This chart should assist in finding or localizing the defective parts. A VTVM and an oscilloscope should be sufficient tools in testing the unit.

6.2 TROUBLE SHOOTING CHART

SYMPTOM	CHECK
6.2.1	
Power switch on, but the pilot light does not come on.	F1
6.2.2	
F1 blows when unit is turned on.	Shorts across power supply outputs. Power supply transistors. Power supply rectifiers. T1.
6.2.3	
No RF output on high or low band.	Power supply voltages. Leveler voltage. Oscillator transistor, Q501. CR502,R602. RF cables.
6.2.4	
RF output on high band, but no RF output on low band.	CW oscillator transistors, Q551 and Q552. CR551,CR552,CR553, and CR554. Video amplifier transistors. +50V supply.
6.2.5	
Insufficient RF output - high band.	Maximum level set potentiometer. R210. +30V supply. -30V supply. Leveler transistors. Sweep oscillator output.

6.2.6	
Insufficient RF output - low band.	Video amplifier transistors, CR551, CR552,CR553, and CR554.
6.2.7	
No horizontal output.	Q101,Q102,Q103,Q104, and Q105.
6.2.8	
No birdy markers.	L301 shorted. Q306,Q307, and Q305.
6.2.9	
Individual marker plug-in socket produces no birdies.	Individual amplifier transistors, Q301,Q302,Q303, and Q304.
6.2.10	
No external marker capability.	CR602. Q306.
6.2.11	
Flatness not meeting specifications.	CR601. Level transistors, Q201, Q202,Q203,Q206, and Q207.
6.2.12	
+30V not present or has excessive ripple.	CR2,CR6,D1D, and C6. Q1,Q2,Q3, and Q4.
6.2.13	
-30V not present or has excessive ripple.	CR3,CR5,C7, and C10. Q5,Q6,Q7, and Q8.
6.2.14	
+200V not present or has excessive ripple.	CR1,CR4,C1A,C1B,C16, and C14. Q9, Q10, and Q11.
6.2.15	
Power supply voltages don't adjust properly.	CR7,CR8,CR9,CR12,CR13,CR14,CR17 and I2. Transistors in power supply.
6.2.16	
Insufficient sweep width.	+200V supply. Q105,Q106,Q107, and R159.
6.2.17	
No blanking.	Q109,Q203, and Q204. CR204.

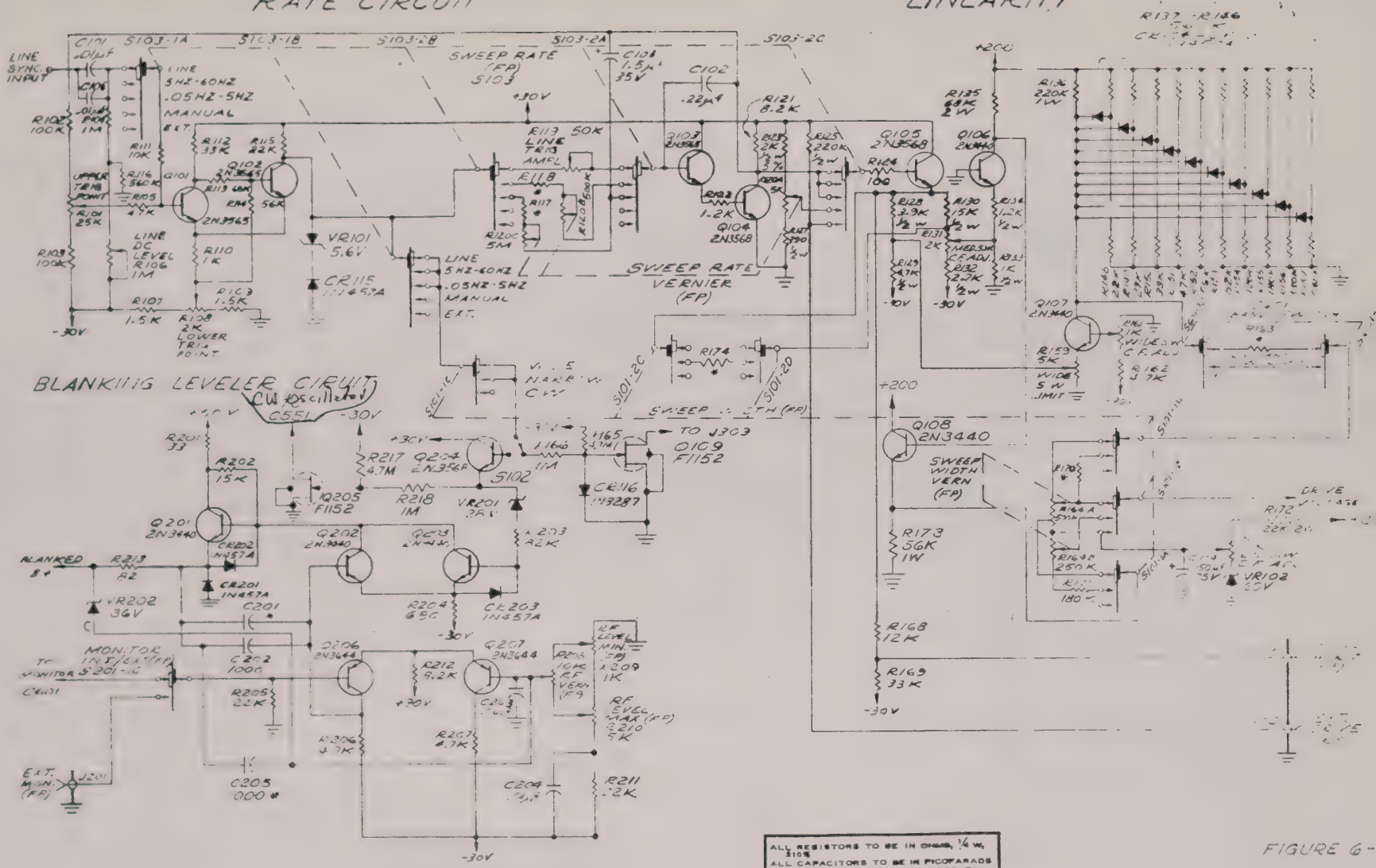
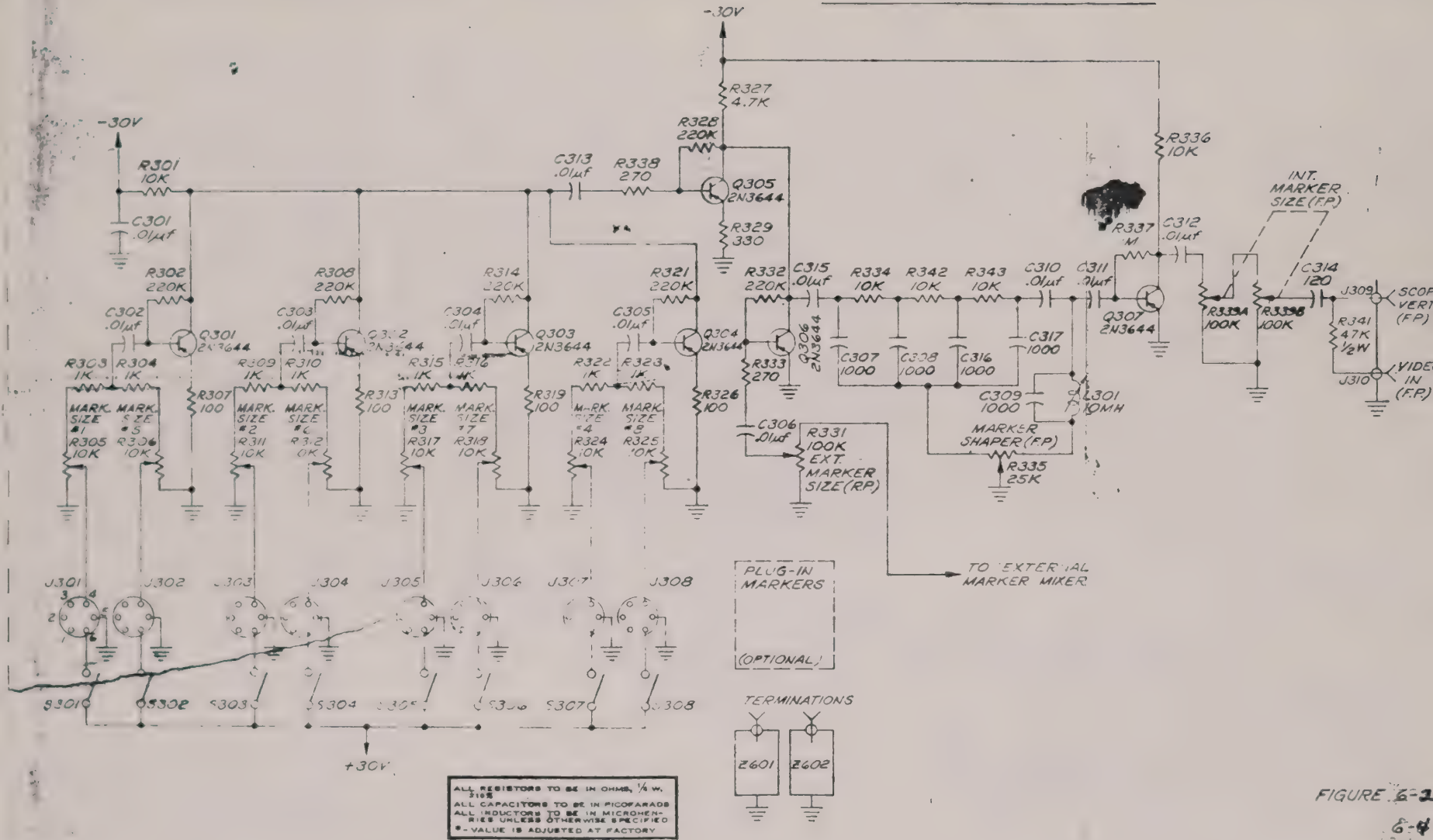

RATE CIRCUIT
LINEARITY
SWEEP RATE (FP) S103
SWEEP RATE VERNIER (FP)
BLANKING LEVELER CIRCUIT
CW Oscillator
LINE SYNC INPUT
LINE 5HZ-60HZ .05HZ-5HZ MANUAL EXT.
LINE DC LEVEL R106 1M
LINE 5HZ-60HZ .05HZ-5HZ MANUAL EXT.
UPPER TRIG POINT
LOWER TRIG POINT
LINE TRIG AMPL
VR101 5.6V
CR115 1N457A
SWEEP WIDTH VERN (FP)
MARKER VOLTS CAL
TO J303 Q109 F1152
Q108 2N3440
Q107 2N3440
Q106 2N3440
Q105 2N3568
Q104 2N3568
Q103 2N3568
Q102 2N3565
Q101 2N3565
Q201 2N3440
Q202 2N3440
Q203 2N3440
Q204 2N3565
Q205 F1152
Q206 2N3644
Q207 2N3644
VR201 3.3V
VR202 36V
CR201 1N457A
CR202 1N457A
CR203 1N457A
CR116 1N3287
BLANKED
MONITOR INPUT (FP)
TV MONITOR
EXT. MON. (FP)
RF LEVEL MIN (FP)
RF LEVEL VERN (FP)
RF LEVEL MAX (FP)
+30V
-30V
+200
ALL RESISTORS TO BE IN OHMS, 1/4 W, 10%
ALL CAPACITORS TO BE IN PICOFARADS
ALL INDUCTORS TO BE IN MICROHENRIES UNLESS OTHERWISE SPECIFIED
* - VALUE IS ADJUSTED AT FACTORY

FIGURE 6-

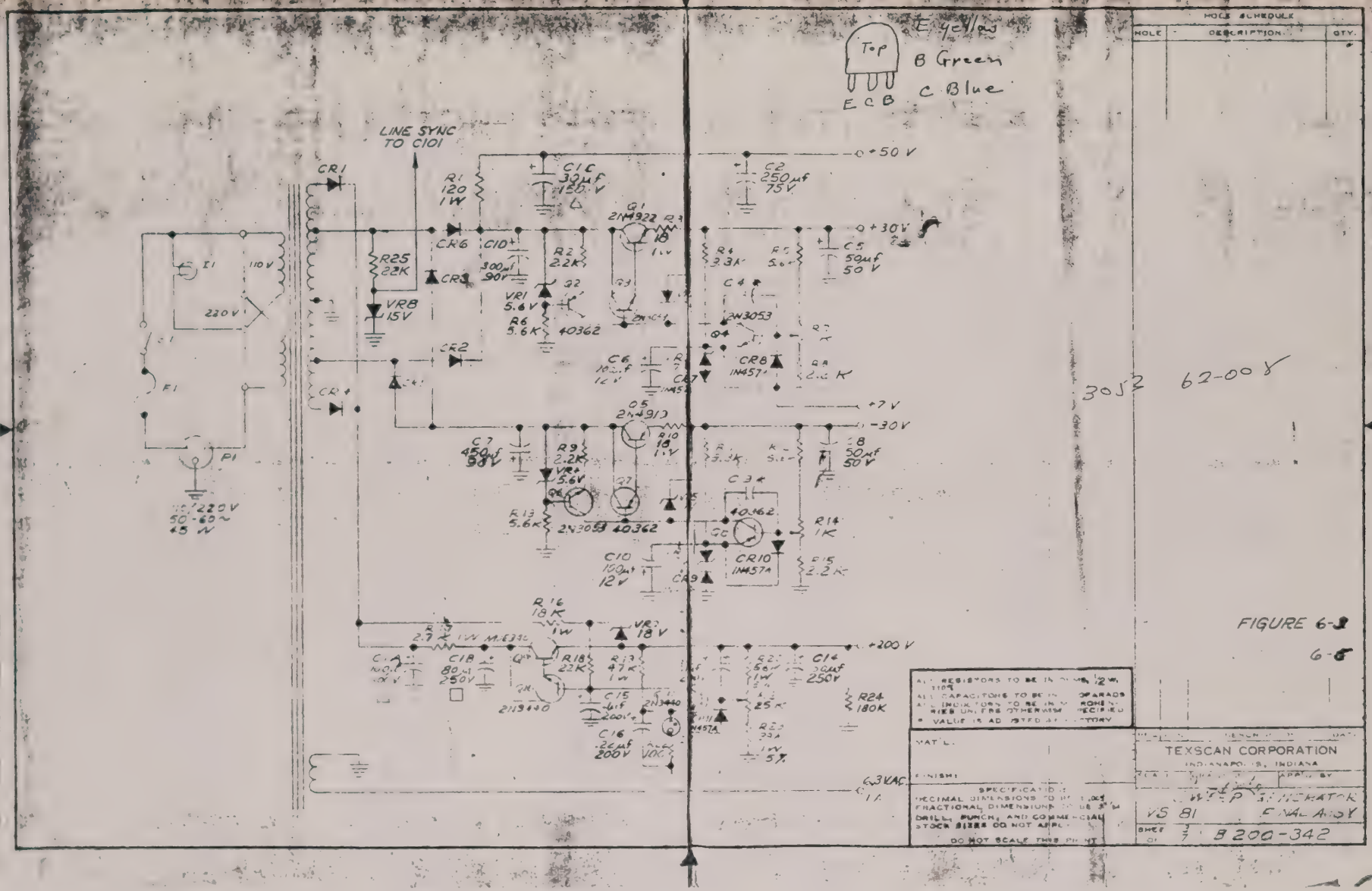
8 PLUG-IN MARKER SOCKETS & MARKER PRE-AMP

BIRDY AMPLIFIER & SHAPER, SWEEP SAMPLE DIVIDER & EXTERNAL MARKER MIXER



ALL RESISTORS TO BE IN OHMS, ¼ W, 2 1/2 %
ALL CAPACITORS TO BE IN PICOFARADS
ALL INDUCTORS TO BE IN MICROHENRIES UNLESS OTHERWISE SPECIFIED
* - VALUE IS ADJUSTED AT FACTORY

FIGURE 6-2



Top
E C B
B Green
C Blue

3052 62-00 X

FIGURE 6-8

6-8

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
C308	012-009	Capacitor, Fixed, 1000pf,500V	RMC SM.001
C309	012-009	Capacitor, Fixed, 1000pf,500V	RMC SM.001
C310	012-050	Capacitor, Fixed, .01uf,100V	RMC TA.01
C311	012-050	Capacitor, Fixed, .01uf,100V	RMC TA.01
C312	012-050	Capacitor, Fixed, .01uf,100V	RMC TA.01
C313	012-050	Capacitor, Fixed, .01uf,100V	RMC TA.01
C314	012-013	Capacitor, Fixed, 120pf	RMC C120N 1500
C315	012-050	Capacitor, Fixed, .01uf,100V	RMC TA.01
C316	012-009	Capacitor, Fixed, 1000pf,500V	RMC SM.001
C317	012-009	Capacitor, Fixed, 1000pf,500V	RMC SM.001
CR1	025-044	Diode, E-8	Sarkes Tarzian E-8
CR2	025-007	Diode, E-4	Sarkes Tarzian E-4
CR3	025-007	Diode, E-4	Sarkes Tarzian E-4
CR4	025-044	Diode, E-8	Sarkes Tarzian E-8
CR5	025-007	Diode, E-4	Sarkes Tarzian E-4
CR6	025-007	Diode, E-4	Sarkes Tarzian E-4
CR7	025-034	Diode, 1N457A	Sylvania 1N457A
CR8	025-034	Diode, 1N457A	Sylvania 1N457A
CR9	025-034	Diode, 1N457A	Sylvania 1N457A
CR10	025-034	Diode, 1N457A	Sylvania 1N457A
CR11	025-034	Diode, 1N457A	Sylvania 1N457A
CR104	025-034	Diode, 1N457A	Sylvania 1N457A
CR105	025-034	Diode, 1N457A	Sylvania 1N457A
CR106	025-034	Diode, 1N457A	Sylvania 1N457A
CR107	025-034	Diode, 1N457A	Sylvania 1N457A
CR108	025-034	Diode, 1N457A	Sylvania 1N457A
CR109	025-034	Diode, 1N457A	Sylvania 1N457A
CR110	025-034	Diode, 1N457A	Sylvania 1N457A
CR111	025-034	Diode, 1N457A	Sylvania 1N457A
CR112	025-034	Diode, 1N457A	Sylvania 1N457A

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
CR113	025-034	Diode, 1N457A	Sylvania 1N457A
CR115	025-034	Diode, 1N457A	Sylvania 1N457A
CR116	025-061	Diode, 1N3287	ITT 1N3287
CR201	025-034	Diode, 1N457A	Sylvania 1N457A
CR202	025-034	Diode, 1N457A	Sylvania 1N457A
CR203	025-034	Diode, 1N457A	Sylvania 1N457A
F1	034-001	Fuse, 3 AG, 1 Amp	Littelfuse 312001
I1	011-001	Bulb, Pilot Light	Drake 6063-634
I2	011-003	Bulb, 82V	Signalite Z82R10
J101	020-016	Connector, RF, 5069	Startronic 5069
J102	020-011	Connector, UG625B/U	Startronic UG625B/U
J201	020-016	Connector, RF, 5069	Startronic 5069
J301	054-003	Socket, 6 Pin	Cinch 201-41-06-243
J302	054-003	Socket, 6 Pin	Cinch 201-41-06-243
J303	054-003	Socket, 6 Pin	Cinch 201-41-06-243
J304	054-003	Socket, 6 Pin	Cinch 201-41-06-243
J305	054-003	Socket, 6 Pin	Cinch 201-41-06-243
J306	054-003	Socket, 6 Pin	Cinch 201-41-06-243
J307	054-003	Socket, 6 Pin	Cinch 201-41-06-243
J308	054-003	Socket, 6 Pin	Cinch 201-41-06-243
J309	020-016	Connector, RF, 5069	Startronic 5069
J310	020-016	Connector, RF, 5069	Startronic 5069
L301	025-008	Inductor, Variable, 10mh	Central Coil H0813-15
P1	019-004	Conductor, Line Cord	Cord Specialty SV-18/3
Q1	062-054	Transistor, 2N4922	Motorola 2N4922

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
Q2	062-043	Transistor, 40362	RCA 40362
Q3	062-005	Transistor, 2N3053	RCA 2N3053
Q4	062-005	Transistor, 2N3053	RCA 2N3053
Q5	062-053	Transistor, 2N4919	Motorola 2N4919
Q6	062-005	Transistor, 2N3053	RCA 2N3053
Q7	062-048	Transistor, 40362	RCA 40362
Q8	062-048	Transistor, 40362	RCA 40362
Q9	062-055	Transistor, MJE340	Motorola MJE340
Q10	062-008	Transistor, 2N3440	RCA 2N3440
Q11	062-008	Transistor, 2N3440	RCA 2N3440
Q101	062-002	Transistor, 2N3565	Fairchild 2N3565
Q102	062-002	Transistor, 2N3565	Fairchild 2N3565
Q103	062-002	Transistor, 2N3565	Fairchild 2N3565
Q104	062-015	Transistor, 2N3568	Fairchild 2N3568
Q105	062-015	Transistor, 2N3568	Fairchild 2N3568
Q106	062-008	Transistor, 2N3440	RCA 2N3440
Q107	062-008	Transistor, 2N3440	RCA 2N3440
Q108	062-008	Transistor, 2N3440	RCA 2N3440
Q109	062-012	Transistor, FET, F1152	Union Carbide F1152
Q201	062-008	Transistor, 2N3440	RCA 2N3440
Q202	062-008	Transistor, 2N3440	RCA 2N3440
Q203	062-008	Transistor, 2N3440	RCA 2N3440
Q204	062-015	Transistor, 2N3568	Fairchild 2N3568
Q205	062-012	Transistor, FET, F1152	Union Carbide F1152
Q206	062-024	Transistor, 2N3644	Fairchild 2N3644
Q207	062-024	Transistor, 2N3644	Fairchild 2N3644
Q301	062-024	Transistor, 2N3644	Fairchild 2N3644
Q302	062-024	Transistor, 2N3644	Fairchild 2N3644
Q303	062-024	Transistor, 2N3644	Fairchild 2N3644
Q304	062-024	Transistor, 2N3644	Fairchild 2N3644
Q305	062-024	Transistor, 2N3644	Fairchild 2N3644

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
Q306	062-024	Transistor, 2N3644	Fairchild 2N3644
Q307	062-024	Transistor, 2N3644	Fairchild 2N3644
R1	046-372	Resistor, Fixed, 120 ohm, 1W, 10%	Allen Bradley
R2	046-124	Resistor, Fixed, 2.2K ohm, ½W, 10%	Allen Bradley
R3	046-337	Resistor, Fixed, 18 ohm, 1W, 10%	Allen Bradley
R4	046-131	Resistor, Fixed, 3.3K ohm, ½W, 10%	Allen Bradley
R5	046-142	Resistor, Fixed, 5.6K ohm, ½W, 10%	Allen Bradley
R6	046-142	Resistor, Fixed, 5.6K ohm, ½W, 10%	Allen Bradley
R7	048-030	Resistor, Variable, 1K ohm	Texscan Corporation
R8	046-124	Resistor, Fixed, 2.2K ohm, ½W, 10%	Allen Bradley
R9	046-124	Resistor, Fixed, 2.2K ohm, ½W, 10%	Allen Bradley
R10	046-337	Resistor, Fixed, 18 ohm, 1W, 10%	Allen Bradley
R11	046-131	Resistor, Fixed, 3.3K ohm, ½W, 10%	Allen Bradley
R12	046-142	Resistor, Fixed, 5.6K ohm, ½W, 10%	Allen Bradley
R13	046-142	Resistor, Fixed, 5.6K ohm, ½W, 10%	Allen Bradley
R14	048-030	Resistor, Variable, 1K ohm	Texscan Corporation
R15	046-124	Resistor, Fixed, 2.2K ohm, ½W, 10%	Allen Bradley
R16	046-463	Resistor, Fixed, 18K ohm, 1W, 10%	Allen Bradley
R17	046-428	Resistor, Fixed, 2.7K ohm, 1W, 10%	Allen Bradley
R18	046-166	Resistor, Fixed, 22K ohm, ½W, 10%	Allen Bradley
R19	046-480	Resistor, Fixed, 47K ohm, 1W, 10%	Allen Bradley
R20	046-483	Resistor, Fixed, 56K ohm, 1W, 5%	Allen Bradley
R21	048-026	Resistor, Variable, 25K ohm	Texscan Corporation
R22	046-068	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R23	046-476	Resistor, Fixed, 39K ohm, 1W, 5%	Allen Bradley
R24	046-205	Resistor, Fixed, 180K ohm, ½W, 10%	Allen Bradley
R25	046-166	Resistor, Fixed, 22K ohm, ½W, 10%	Allen Bradley
R101	048-026	Resistor, Variable, 25K ohm	Texscan Corporation
R102	045-794	Resistor, Fixed, 100K ohm, ½W, 10%	Allen Bradley
R103	045-794	Resistor, Fixed, 100K ohm, ½W, 10%	Allen Bradley

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R104	045-836	Resistor, Fixed, 1M ohm, ½W, 10%	Allen Bradley
R105	045-780	Resistor, Fixed, 47K ohm, ½W, 10%	Allen Bradley
R106	048-032	Resistor, Variable, 1M ohm	Texscan Corporation
R107	045-717	Resistor, Fixed, 1.5K ohm, ½W, 10%	Allen Bradley
R108	048-023	Resistor, Variable, 2K ohm	Texscan Corporation
R109	045-717	Resistor, Fixed, 1.5K ohm, ½W, 10%	Allen Bradley
R110	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R111	045-752	Resistor, Fixed, 10K ohm, ½W, 10%	Allen Bradley
R112	045-773	Resistor, Fixed, 33K ohm, ½W, 10%	Allen Bradley
R113	045-787	Resistor, Fixed, 68K ohm, ½W, 10%	Allen Bradley
R114	045-784	Resistor, Fixed, 56K ohm, ½W, 10%	Allen Bradley
R115	045-766	Resistor, Fixed, 22K ohm, ½W, 10%	Allen Bradley
R116	045-826	Resistor, Fixed, 560K ohm, ½W, 10%	Allen Bradley
R117		Factory Selected Value	Texscan Corporation
R118		Factory Selected Value	Texscan Corporation
R119	048-054	Resistor, Variable, 50K ohm	CTS UPE200RE
R120A,B,C,S103	048-094	Resistor, Variable, 5K/500K/5M ohm, Switch	CTS C212-25211-3-3
R121	045-749	Resistor, Fixed, 8.2K ohm, ½W, 10%	Allen Bradley
R122	045-714	Resistor, Fixed, 1.2K ohm, ½W, 10%	Allen Bradley
R123	046-122	Resistor, Fixed, 2K ohm, ½W, 5%	Allen Bradley
R124	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R125	046-208	Resistor, Fixed, 220K ohm, ½W, 10%	Allen Bradley
R127	046-093	Resistor, Fixed, 390 ohm, ½W, 10%	Allen Bradley
R128	046-135	Resistor, Fixed, 3.9K ohm, ½W, 10%	Allen Bradley
R129	046-138	Resistor, Fixed, 4.7K ohm, ½W, 10%	Allen Bradley
R130	046-159	Resistor, Fixed, 15K ohm, ½W, 10%	Allen Bradley
R131	048-023	Resistor, Variable, 2K ohm	Texscan Corporation
R132	046-128	Resistor, Fixed, 2.7K ohm, ½W, 10%	Allen Bradley
R133	046-110	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R134	046-114	Resistor, Fixed, 1.2K ohm, ½W, 10%	Allen Bradley

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R135	046-787	Resistor, Fixed, 68K ohm, 2W, 10%	Allen Bradley
R136	046-508	Resistor, Fixed, 220K ohm, 1W, 5%	Allen Bradley
R137	045-826	Resistor, Fixed, 560K ohm, ½W, 10%	Allen Bradley
R138	045-826	Resistor, Fixed, 560K ohm, ½W, 10%	Allen Bradley
R139	045-826	Resistor, Fixed, 560K ohm, ½W, 10%	Allen Bradley
R140	045-826	Resistor, Fixed, 560K ohm, ½W, 10%	Allen Bradley
R141	045-826	Resistor, Fixed, 560K ohm, ½W, 10%	Allen Bradley
R142	045-826	Resistor, Fixed, 560K ohm, ½W, 10%	Allen Bradley
R143	045-826	Resistor, Fixed, 560K ohm, ½W, 10%	Allen Bradley
R144	045-826	Resistor, Fixed, 560K ohm, ½W, 10%	Allen Bradley
R145	045-826	Resistor, Fixed, 560K ohm, ½W, 10%	Allen Bradley
R146	045-826	Resistor, Fixed, 560K ohm, ½W, 10%	Allen Bradley
R148		Factory Selected Value	Texscan Corporation
R149		Factory Selected Value	Texscan Corporation
R150		Factory Selected Value	Texscan Corporation
R151		Factory Selected Value	Texscan Corporation
R152		Factory Selected Value	Texscan Corporation
R153		Factory Selected Value	Texscan Corporation
R154		Factory Selected Value	Texscan Corporation
R155		Factory Selected Value	Texscan Corporation
R156		Factory Selected Value	Texscan Corporation
R157		Factory Selected Value	Texscan Corporation
R159	048-024	Resistor, Variable, 5K ohm	CTS UPE200RE
R161	048-030	Resistor, Variable, 1K ohm	CTS UPE200RE
R162	045-738	Resistor, Fixed, 4.7K ohm, ½W, 10%	Allen Bradley
R163		Factory Selected Value	Texscan Corporation
R164A,B,S101	048-078	Resistor, Variable, 500K/250K ohm, Switch	CTS C212-A19436-2-2-VC
R165	045-864	Resistor, Fixed, 4.7M ohm, ½W, 10%	Allen Bradley
R166	045-836	Resistor, Fixed, 1M ohm, ½W, 10%	Allen Bradley
R167	048-080	Resistor, Variable, 1K ohm	CTS UPM45

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R168	045-756	Resistor, Fixed, 12K ohm, ½W, 10%	Allen Bradley
R169	045-773	Resistor, Fixed, 33K ohm, ½W, 10%	Allen Bradley
R170		Factory Selected Value	Texscan Corporation
R171	045-805	Resistor, Fixed, 180K ohm, ½W, 10%	Allen Bradley
R173	046-482	Resistor, Fixed, 56K ohm, 1W, 10%	Allen Bradley
R201	045-647	Resistor, Fixed, 33 ohm, ½W, 10%	Allen Bradley
R202	045-759	Resistor, Fixed, 15K ohm, ½W, 10%	Allen Bradley
R203	045-791	Resistor, Fixed, 82K ohm, ½W, 10%	Allen Bradley
R204	045-703	Resistor, Fixed, 680 ohm, ½W, 10%	Allen Bradley
R205	045-766	Resistor, Fixed, 22K ohm, ½W, 10%	Allen Bradley
R206	045-738	Resistor, Fixed, 4.7K ohm, ½W, 10%	Allen Bradley
R207	045-738	Resistor, Fixed, 4.7K ohm, ½W, 10%	Allen Bradley
R208, S201	048-059	Resistor, Variable, 10K ohm, Switch	CTS C212-22016-1-45
R209	048-035	Resistor, Variable, 1K ohm	CTS 200
R210	048-036	Resistor, Variable, 5K ohm	CTS 200
R211	045-766	Resistor, Fixed, 22K ohm, ½W, 10%	Allen Bradley
R212	045-749	Resistor, Fixed, 8.2K ohm, ½W, 10%	Allen Bradley
R213	045-665	Resistor, Fixed, 82 ohm, ½W, 10%	Allen Bradley
R217	045-864	Resistor, Fixed, 4.7M ohm, ½W, 10%	Allen Bradley
R218	045-836	Resistor, Fixed, 1M ohm, ½W, 10%	Allen Bradley
R301	045-752	Resistor, Fixed, 10K ohm, ½W, 10%	Allen Bradley
R302	045-808	Resistor, Fixed, 220K ohm, ½W, 10%	Allen Bradley
R303	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R304	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R305	048-014	Resistor, Variable, 10K ohm	CTS UHT201
R306	048-014	Resistor, Variable, 10K ohm	CTS UHT201
R307	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R308	045-808	Resistor, Fixed, 220K ohm, ½W, 10%	Allen Bradley
R309	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R310	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R311	048-014	Resistor, Variable, 10K ohm	CTS UHT201

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R313	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R314	045-808	Resistor, Fixed, 220K ohm, ½W, 10%	Allen Bradley
R315	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R316	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R317	048-014	Resistor, Variable, 10K ohm	CTS UHT201
R318	048-014	Resistor, Variable, 10K ohm	CTS UHT201
R319	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R321	045-808	Resistor, Fixed, 220K ohm, ½W, 10%	Allen Bradley
R322	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R323	045-710	Resistor, Fixed, 1K ohm, ½W, 10%	Allen Bradley
R324	048-014	Resistor, Variable, 10K ohm	CTS UHT201
R325	048-014	Resistor, Variable, 10K ohm	CTS UHT201
R326	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R327	045-738	Resistor, Fixed, 4.7K ohm, ½W, 10%	Allen Bradley
R328	045-808	Resistor, Fixed, 220K ohm, ½W, 10%	Allen Bradley
R329	045-689	Resistor, Fixed, 330 ohm, ½W, 10%	Allen Bradley
R331	048-057	Resistor, Variable, 100K ohm	CTS C45-2D
R332	045-808	Resistor, Fixed, 220K ohm, ½W, 10%	Allen Bradley
R333	045-686	Resistor, Fixed, 270 ohm, ½W, 10%	Allen Bradley
R334	045-752	Resistor, Fixed, 10K ohm, ½W, 10%	Allen Bradley
R335, R339A, B	048-060	Resistor, Variable, 25K/100K/100K ohm	CTS C45-2-45
R336	045-752	Resistor, Fixed, 10K ohm, ½W, 10%	Allen Bradley
R337	045-836	Resistor, Fixed, 1M ohm, ½W, 10%	Allen Bradley
R338	045-686	Resistor, Fixed, 270 ohm, ½W, 10%	Allen Bradley
R341	046-180	Resistor, Fixed, 47K ohm, ½W, 10%	Allen Bradley
R342	045-752	Resistor, Fixed, 10K ohm, ½W, 10%	Allen Bradley
R343	045-752	Resistor, Fixed, 10K ohm, ½W, 10%	Allen Bradley
S1	057-004	Switch, Toggle, SPST	Cutler-Hammer 8280K16
S102	057-003	Switch, Slide	Continental-Wirt Q126
S301	057-002	Switch, Rocker, DPDT	Stackpole RS-50-FB

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
S302	057-002	Switch, Rocker, DPDT	Stackpole RS-50-FB
S303	057-002	Switch, Rocker, DPDT	Stackpole RS-50-FB
S304	057-002	Switch, Rocker, DPDT	Stackpole RS-50-FB
S305	057-002	Switch, Rocker, DPDT	Stackpole RS-50-FB
S306	057-002	Switch, Rocker, DPDT	Stackpole RS-50-FB
S307	057-002	Switch, Rocker, DPDT	Stackpole RS-50-FB
S308	057-002	Switch, Rocker, DPDT	Stackpole RS-50-FB
S601	C200-030-02	Switch	Texscan Corporation
VR1	025-018	Diode, Zener, 1N708,5.6V	Texas Instruments 1N708
VR2	025-033	Diode, Zener, VR7A	Sarkes Tarzian VR7A
VR3	025-033	Diode, Zener, VR7A	Sarkes Tarzian VR7A
VR4	025-018	Diode, Zener, 1N708,5.6V	Texas Instruments 1N708
VR5	025-033	Diode, Zener, VR7A	Sarkes Tarzian VR7A
VR6	025-033	Diode, Zener, VR7A	Sarkes Tarzian VR7A
VR7	025-025	Diode, Zener, VR18A	Sarkes Tarzian VR18A
VR8	025-038	Diode, Zener, VR15A	Sarkes Tarzian VR15A
VR101	025-018	Diode, Zener, 1N708,5.6V	Texas Instruments 1N708
VR102		Factory Selected Value	Texscan Corporation
VR201	025-024	Diode, Zener, VR28A	Sarkes Tarzian VR28A
VR202	025-022	Diode, Zener, VR36A	Sarkes Tarzian VR36A